Space Weather Technical Forecast

Issued on Friday, 26 November 2021 at 00:33 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Weak CME arrival expected this weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Very Low over the past 24 hours, with no significant X-ray flares. There are currently two active regions on the visible disc; one a new and yet to be numbered region in the southwest quadrant, a weak and small Bxo/beta group. The only numbered region, AR2898 in the southeastern quadrant, is currently classified as Dao/beta, and is showing signs of slight decay.
No Earth-directed CMEs were identified in available imagery.

Solar Wind / Geomagnetic Activity: The solar wind indicated the departure from a previous high speed stream, probably that emanating from coronal hole 20. The solar wind speed was initially around 450 km/s, peaking at 477 km/s at 25/0034 UTC, with a negative phi angle (towards the Sun). The solar winds, as measured by DSCOVR at L1, gradually declined to end the day around 400 km/s. Meanwhile during the evening the phi angle become more erratic and often positive (away from the Sun). The solar wind density was unremarkable in high single figures ppcc, while the IMF peaked at 5nT, with a north-south component between +/-4nT. The result of these solar wind measures was Quiet (Kp 1-2) geomagnetic activity throughout.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) remained at Background levels. The high energy electron flux (greater than 2 MeV) was predominantly at Moderate levels, just touching High levels once; reaching 1000 pfu at 25/1150 UTC. The associated 24-hour integrated fluence remained below the Active threshold (1e8 integrated pfu), with a gradually decreasing trend, reaching 3.78e7 integrated pfu was recorded at 26/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Very Low, with 20% chance of C-class flares. No new significant regions are expected to rotate onto the visible disc until day 4, when a region may rotate onto the northeast limb.

Solar Wind / Geomagnetic Activity: A CME from a filament eruption leaving the Sun 24/1300UTC may reach Earth late Saturday 27, possibly early Sunday 28 November. There is considered to be a Chance of G1 from this event, probably peaking within the UTC day of Sunday 28 November (Day 3).

Quiet geomagnetic activity is expected until the potential arrival of the CME, then increasing Unsettled to Active (Kp 3-4) late Day 2 (27th) into early Day 3 (28th), with a Chance of G1/Minor Geomagnetic storm intervals (Kp 5). From late Day 3 and into Day 4 Quiet to Unsettled (Kp 1-3) geomagnetic activity is expected.

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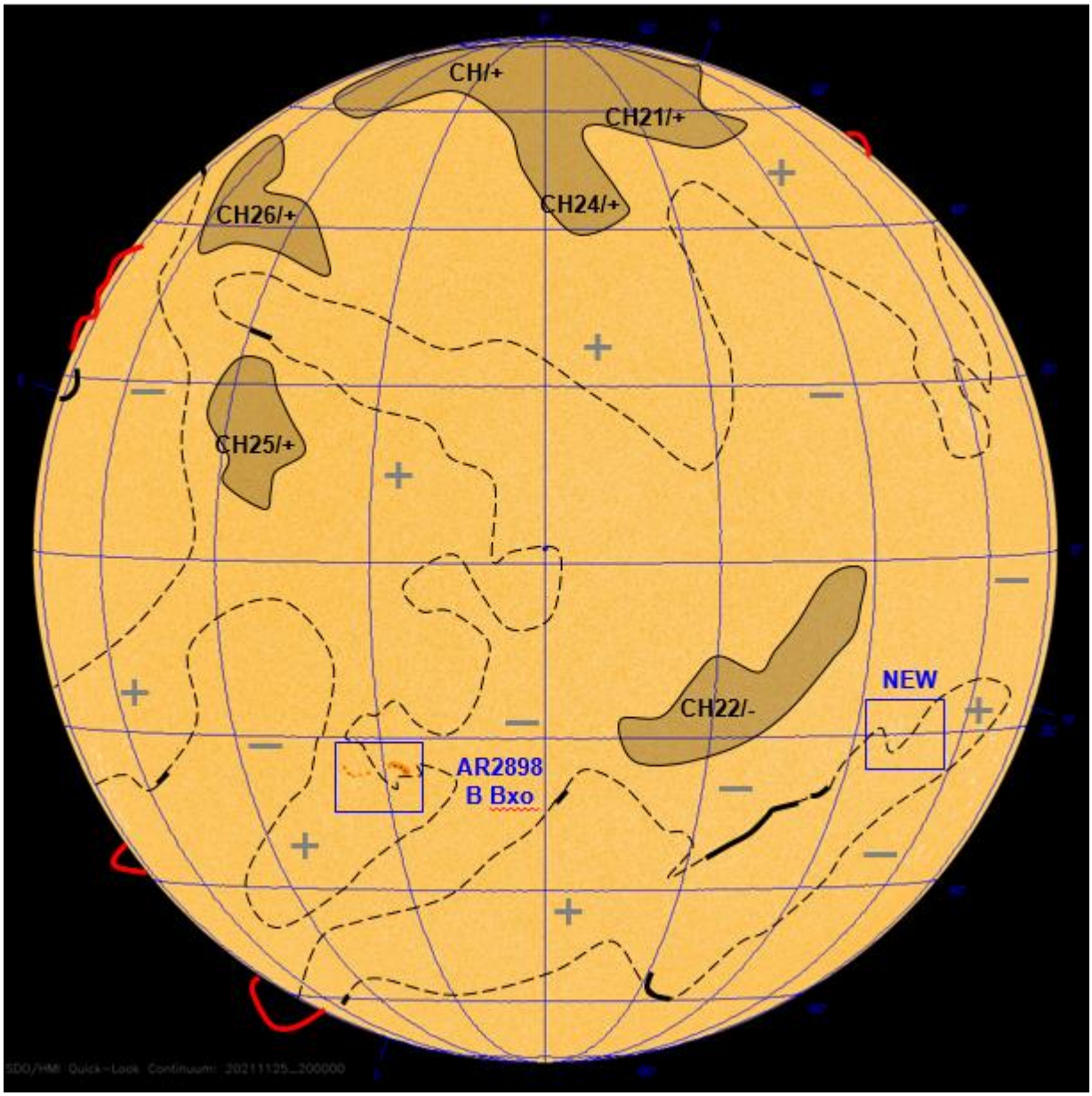
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to decrease to Low to Moderate levels by late day 2 (27th) before the potential CME arrives. Thereafter generally Moderate levels are expected, but with a chance of exceeding High levels temporarily at the peak of the diurnal cycles during Days 3 and 4. The associated 24-hour integrated fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 25/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A filament eruption observed in the southeastern quadrant around 24/1300UTC has resulted in a CME with a possible Earth-directed component. This feature is currently forecast to reach Earth either late Saturday 27 or early Sunday 28 November, with the arrival most likely on the 27th. The material from the CME appears to be angled mostly below the ecliptic plane as well as slightly eastward, which lowers confidence of a direct impact for Earth. Therefore, only a chance of a G1/Minor geomagnetic storm is considered, peaking early Sunday 28 November.
The solar wind parameters indicate the Earth has now exited from the previous HSS from CH20. With no further significant coronal hole features expected, the solar wind is expected to remain at predominantly background levels, just occasionally becoming slightly elevated, mainly with the arrival of the potential CME.

Quiet geomagnetic activity is expected until the possible arrival of the CME, then increasing Unsettled to Active (Kp 3-4) late Day 2 (27th) into early Day 3 (28th), with a Chance of G1/Minor Geomagnetic storm intervals (Kp 5). From late Day 3 and into Day 4 Quiet to Unsettled (Kp 1-3) geomagnetic activity is expected.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	30	5
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
24/2058 UTC	Partial Halo	Filament Eruption	SE Quadrant	500	27/2300 UTC	Mainly angled below and behind Earth

Figure 2: Latest MOSWOC Enlil and Ensemble output, with the deterministic run showing an arrival of around 27/2300 UTC.

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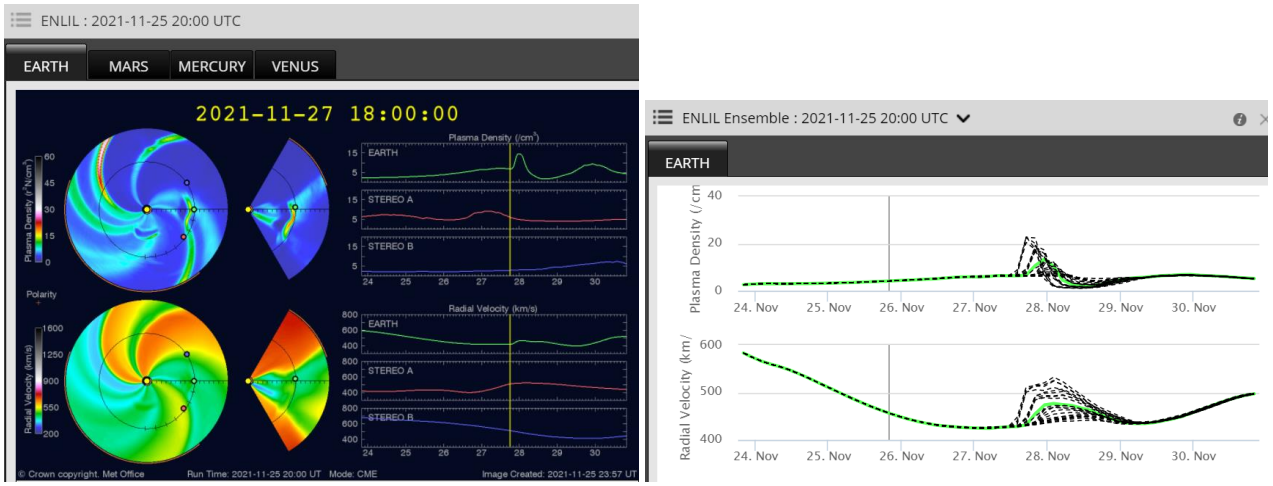

Radio Blackouts - X-Ray Flares:

AR2898 remains a Dao/beta group, although the penumbra on the trailing spots is shrinking and so the group is edging closer to becoming a Cao classification. A new region has emerged in the western hemisphere, and is currently a very small and simple Bxo/beta group. Despite the emergence of this new region, and the continued presence of AR2898, solar activity is expected to remain Very Low with the issued probabilities of significant flares below those of the raw values. This is due to the lack of any recent significant activity, plus there are no signs of either sunspot region developing and becoming significantly active.

No new significant regions are expected to rotate onto the visible disc until day 4, when a region may rotate onto the northeast limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	1	1	1	1
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: Latest STEREO Ahead EUVI 195 image showing a potential new region, which may rotate onto the northeast limb later in the forecast period.

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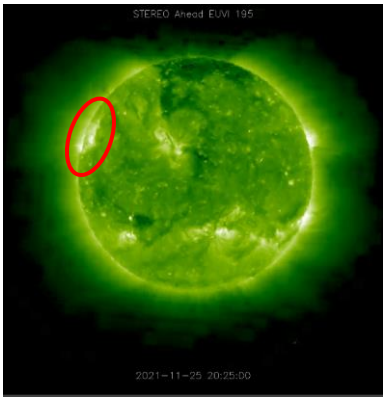

Solar Radiation Storms - (High Energy Protons):

In the absence of any significant flare activity, the high energy proton flux (greater than 10 MeV) is forecast to remain at background levels, with no solar radiation storms anticipated.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

Now that Earth has exited the HSS from CH20 the high energy electron flux (greater than 2 MeV) is expected to decrease to Low to Moderate levels by late tomorrow (27th), before the potential CME arrives. Thereafter generally Moderate levels are expected, but with a chance of exceeding High levels temporarily at the peak of the diurnal cycles during Days 3 and 4. The associated 24-hour integrated fluence is expected to remain below the Active threshold.

Current MOSWOC REFM output maintains the fluence below the Active threshold, and this is accepted.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Met Office REFM model.

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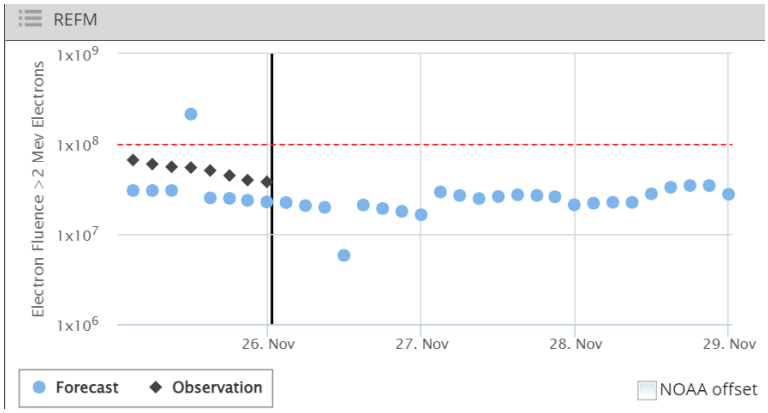

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